Process control system and method for operating a system of this type

Description

The invention relates to a process control system, which expression means not only small but also large systems for open-loop and closed-loop control of a technical process. In particular, the invention relates to the sensor system used in this case and to the self-diagnosis of sensors, actuators and all other appliances which can interchange additional information in a process.

Any technical process which must be controlled is provided with sensors which determine the actual state of the process. The sensors in known systems pass on their measurement data to a central system. The measurement data, such as the temperature, frequently represents only indirectly desired information. The actually required information characterizing a process or a product is obtained by derivatives from the measurement data and by calculations.

Figure 2 shows a schematic illustration of one known arrangement for process control, in this case for determination of the flow. In this case, a process is annotated 7, with an associated temperature sensor 9a, a pressure sensor 9b and, possibly, further sensors 9c. The viscosity of the medium and its density are calculated from the measurement values recorded in this way. The flow is then obtained in accordance with Hagen-Poisseuille from the overall determined variables:

$$V = \Delta p_v * \pi * D^4 / (128 * \eta * l)$$

η - viscosity

Δp_v - pressure loss

$D_5$1 - tube geometry

This calculation is carried out at a central point, for example in a control console 10, to which all the measurement values are supplied via transmission paths 8a to 8c. The calculation result can be called up only at the control console 10.

The centralization of the measurement value processing which this results in has the disadvantage that data and information can be passed on only from the information node, that is to say from the control console, since this is the only place that the data processing algorithms are stored. For a local operator, for example at the location of a sensor, it is, however, often necessary to directly know the further-processed information in order to allow assessment of the process or the product. Furthermore, the measured variables are frequently only of indirect interest to the operator in order to obtain statements about the quality of a product or the status of an installation. For example, pressure is often measured only to determine the flow from it, and the temperature in order to determine the density and the viscosity of a medium from it.

The invention is thus based on the object of specifying a system with improved access to process information. A further aim is to specify a method for operation of a system such as this.

This object is achieved by a process control system which has the features specified in claim 1. Advantageous refinements and a method for operation of a system such as this are specified in further claims.

The invention accordingly proposes a process control

system whose measurement devices and actuators are equipped with means for information processing and for data interchange between these measurement devices and actuators. The measurement devices and actuators are connected to one another, thus allowing data interchange. This results in a system with distributed intelligence in which, furthermore, all of the information relating to the process state is available in each measurement device and in each actuator. All of these devices have means for data processing, that is to say by way of example microcomputers with the necessary software, that is to say the required algorithms, such as the general gas equation, in order to allow calculation of the process information of interest.

A further description of the process control system according to the invention as well as its method of operation and of the advantages associated with it will be given in the following text on the basis of one exemplary embodiment, which is illustrated in drawing figures, in which:

Figure 1 shows, schematically, one possible arrangement of a process control system according to the invention, and

Figure 2 shows a corresponding arrangement for a process control system according to the prior art.

Figure 1 shows a process 7 which has associated measurement devices with sensors 2a, 2b and 2c as well as an actuator 3 as components of a process control system. All of the measurement devices and actuators in a process control system such as this each contain a processing device 1 as well as an interface device 5

for connection of a service appliance 6. It is self-evident that the interface device 5 may also be omitted in exceptional cases, when there is no need to provide the capability to connect a service appliance 6 to the corresponding device or measurement point. By way of example, a microcomputer with associated software can be used as the processing device 1, with algorithms which are required in the system either being stored as standard in all of the microcomputers or being entered only in individual system components 2a, 2b, 2c, 3 by means of the service appliance 6, via the interface device 5.

The illustrated process control system offers the capability to call all process-related data at any desired measurement point. The data interchange which is required for this purpose between the system components 2a, 2b, 2c, 3 takes place via bidirectionally operating data interchange means 4a, 4b, 4c and 4d. For example, it is thus possible to read the pressure recorded in a measurement device 2b and a flow determined in the measurement device 2c at a temperature measurement point 2a. In this case, pressure and temperature data are passed on directly via point-to-point links 4b and 4a, while the flow is determined from the pressure and temperature data, and the data from the flowmeter 2c. It is self-evident that other data transmission means, for example bus systems, are also suitable, in addition to point-to-point links. The local preprocessing of the data and the interchange of all data furthermore make it possible to obtain the actually process-relevant variables. In principle, there is therefore no need for central processing of the measurement values. This simplifies the control process for the local operator and reduces the hardware complexity, since, for example, a PDA or a notebook is sufficient for reading. However, this does not preclude

the possibility, if required, of nevertheless also providing a control console, from which data can be read or parameter changes can be implemented.

The interchange of the measurement values between the components of the process control system and the local processing of the data also offers capabilities for diagnosis of individual sensors and of the overall system, since this type of information interchange is not limited to instruments, but also includes actuators. Thus, for example, a valve regulator can pass on information relating to the valve position to adjacent flowmeters which themselves pass back a message which states whether the message "valve closed" also actually results in "zero" flow.

Furthermore, the operating data can be used to carry out self-diagnosis in the respective interface device, for example by means of plausibility checks, provided that suitable algorithms are stored there.